

COURSE REPORT

Ecosystem Services and Tropical Forest Restoration

ELTI Permanent Training Sites
Agua Salud Project, Province of Colon, Panama
January 25-30, 2016

A field course organized by:
The Environmental Leadership & Training Initiative (ELTI)
and the Smithsonian Tropical Research Institute (STRI)



Background: Tropical forests in Panama and around the world are rapidly disappearing, and with them a range of ecosystem services necessary to maintain life on the planet. The consequences of deforestation and forest degradation are becoming more apparent in Panama, especially due to extreme weather from climate change and the El Niño Phenomenon. In response to these threats and the need to recuperate ecosystem services, interest in conserving and restoring tropical forests has grown. In order to effectively promote these activities and to best inform the decisions regarding the development of strategies for restoration and land use planning, there needs to be a more profound understanding of the ecological processes underlying forests and the services they provide.

ELTI is an initiative of:

Yale SCHOOL OF FORESTRY &
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In collaboration with:

Smithsonian Tropical Research Institute  PANAMA



One approach to forest restoration capacity building is through intensive field-based courses situated in diverse biophysical and socio-economic landscapes. Field-based courses provide participants with the opportunity to actively engage in exercises that illustrate the importance of integrating scientific investigation into the development of adequate restoration strategies. Since 2013, ELTI has taken this approach by developing focal training sites in both wet and dry tropical forest ecosystems in Panama, where the Yale School of Forestry and Environmental Studies (F&ES) and STRI conduct long-term forest restoration research and experiments. ELTI's focal training site located at the Agua Salud Project of STRI, utilizes an interpretative trail network and demonstration areas to provide course participants the opportunity to learn about on-going research and partake in hands-on exercises, which illustrates the importance of the scientific method to develop sound restoration strategies.

The training was offered to thirteen international environmental practitioners and professionals from throughout Latin America and the Caribbean, who were interested in strengthening their forest restoration knowledge and practical skills. Over a period of six days, course participants learned the technical skills necessary to design and implement strategies to increase forest cover and ecosystem services in modified, multi-use landscapes, with particular focus in watersheds. Special attention was focused on understanding the social drivers of forest degradation and restoration. Additionally, participants had the opportunity to learn and exchange experiences, concepts and practical tools with ELTI facilitators, international experts and amongst other professional peers.

Objectives: This field course was designed to convey the concepts, techniques and advances of tropical forest restoration through a series of lectures, case studies and field-based visits. In addition, the course focused on the following four objectives:

- To present the fundamentals of tropical forest ecology and the scientific advancements to quantify ecosystem services in multiple-use landscapes of the seasonal tropics.



- To present the basic principles of forest disturbances, environmental degradation and its consequences upon the integrity of ecosystem services, natural regeneration and forest restoration.
- To illustrate the range of forest restoration options and provide the opportunity to evaluate both biophysical and socio-economic variables in order to select the most appropriate forest restoration strategies, tools and technologies available to guide the decision making process.
- Provide participants from throughout Latin America with the opportunity to meet and establish contacts for collaboration, technical assistance and to generate projects that can be supported through ELTI's Leadership Program.

Field-Course Format: This course took place at ELTI's wet tropical forest training site that is located in STRI's Agua Salud Project (referred to as Agua Salud). Agua Salud is an ideal setting for field-based forest restoration courses, as the project attempts to understand and quantify the ecological, social and economic services provided by multiple-use landscapes in the Panama Canal Watershed (PCW). Course themes were taught via classroom lectures that included discussions of readings and case studies and field visits to Agua Salud consisted of demonstrative lectures, observations and active group exercises.

Beyond Agua Salud, participants visited a series of other important sites inside the PCW to better understand the socio-economic context of forest restoration: (1) a native species tree nursery managed by a community-based women's group: The Association of Agro-ecological Producers of the Gatuncillo River (APARGA); (2) the Quintero Farm, a locally owned small-scale conventional farm; (3) a model silvopastoral cattle ranch participating in the Panama Canal Authority's (ACP) Environmental Economic Incentives Program (PIEA); (4) the Pedro Miguel Locks of the Panama Canal; (5) the Madden Dam and Alajuela Lake Reservoir of the ACP.



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The course was divided into three training modules:

- **Module 1:**
The fundamentals of forest ecology and ecosystem services in wet tropical forests

This module included lectures that introduced: (1) the importance of forest restoration and how the Agua Salud Project strives to develop sound applied ecological science; (2) the provision and regulation of ecosystem services; (3) tropical forest ecology; (4) tropical forest dynamics; and (5) best practices for forest measurements and statistical analysis. Lectures were followed by field visits to the ELTI demonstration sites that were selected to illustrate different age classes of secondary forests. Participants observed and recorded the following attributes within the sites: (1) abiotic and biotic site characteristics; (2) ecosystem services (species diversity, biomass and carbon); and (3) forest disturbance and successional pathways.

- **Module 2:**
Limitations for the restoration and the provision of ecosystem services

The second module covered the core concepts of addressing the degradation of wet tropical forests and specifically the ecological effects of degradation and the drivers of degradation in tropical forests. The primary points of this lecture were highlighted during a visit to a local landowner's farm to illustrate the effects of conventional agricultural practices upon the ecosystem's integrity to provide ecosystem services. In addition, participants visited numerous secondary forests undergoing different successional pathways after abandonment. Participants observed the site's soils and vegetation characteristics and compared them against other less disturbed areas and sites undergoing restoration activities.



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- **Module 3:**
Strategies for restoring ecosystem services in human-modified landscapes

This module introduced the participants to a conceptual framework used to develop restoration strategies, which takes into account both biophysical and social variables of a degraded site. Based on the diagnosis from the framework, participants learned about the gradient of passive to active restoration strategies: (1) natural forest regeneration such as assisted natural regeneration (ANR); (2) active restoration (reforestation); and (3) strategies for restoration in human dominated or productive landscapes (agroforestry and silvopastoral systems). Participants also learned about the Native Species Reforestation Project (known by the Spanish acronym PRO-RENA), which highlighted results from long-term trials and research conducted via reforestation. In the field, participants visited examples of the passive to active range of restoration strategies and conducted forest measurements exercises and observations to quantify results. In addition, participants were shown how to conduct monitoring of restoration strategies in order to quantify the ecosystems being produced on each different land use and intervention.

For the final exercise, participants visited a local farm with degraded soils due to years of conventional agricultural practices. Participants were divided into groups that represented varying objectives of potential (fictional) buyers of the property. Each group was required to conduct a rapid assessment and develop a restoration plan based on the buyer's restoration objectives (timber, biodiversity, forest connectivity and production) and provide the buyer with different strategies to meet their goals. The exercise reinforced the importance of making decisions based upon well-researched, site-specific biophysical and socio-economic information before implementing a restoration strategy.



Participants: The thirteen individuals selected to attend the course represented a number of organizations including: (1) the government; such as Panama's Institute of Agricultural Development (IDIAP), the Costa Rican Institute of Electricity, the National System of Conservation Areas (Costa Rica), Haitian National Park Service; (2) autonomous government entities such as the Panama Canal Authority (ACP); (3) NGOs including; the Center for International Forestry Research (CIFOR-Peru) the Natura Foundation (Colombia), the Center for Research on Sustainable Agriculture Production Systems (CIPAV - Colombia), the Alexander von Humboldt Institute (Colombia), the Albert Schweitzer Hospital (Haiti), the Guanacas Foundation (Colombia), the Madremonte Ecological Association (Colombia), Paso Pacífico (Nicaragua); and (4) the private sector; Minera Panama.

Instructors: The course was facilitated in Spanish by experts from STRI, ELTI and other local partners as listed below:

- Dr. Jefferson Hall, Smithsonian Tropical Research Institute (STRI), United States
- Dr. Dylan Craven, German Centre for Integrative Biodiversity Research (iDiv), United States
- Jorge Batista, Smithsonian Tropical Research Institute (STRI), Panama
- Mario Bailón, Smithsonian Tropical Research Institute (STRI), Panama
- Arturo Cerezo, M.Sc., Panama Canal Authority, Panama
- Saskia Santamaría, Environmental Leadership and Training Initiative (ELTI), Panama
- Jacob L. Slusser, M.Sc., Environmental Leadership and Training Initiative (ELTI), United States
- Estrella Yanguas, M.Sc., Smithsonian Tropical Research Institute (STRI) - Agua Salud Project, Spain

Outcomes and Follow-up: Participants were actively engaged in learning about the ecology and restoration of wet tropical forests throughout the course. Participants provided brief presentations highlighting their professional work related to restoration, which facilitated further exchange of knowledge and the potential for collaboration amongst their peers. Course evaluations received high ratings. An impact assessment will be implemented in six months with course alumni to gauge effectiveness and interest to participate in the Leadership Program.

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